Evaluation of Postprocedural Pain and Quality-of-Life Improvement in Rural Patients with Chronic Venous Insufficiency Undergoing Endovenous Laser Ablation

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J Clin Interv Radiol ISVIR 2019;3:81–88

Abstract

Background Chronic venous insufficiency (CVI) manifests as unilateral or bilateral lower-limb venous hypertension causing pain, swelling, edema, and skin changes, among other symptoms. CVI affects patients' socioeconomic status, is particularly seen in the young, and, in its severe manifestation, may have a debilitating effect on patients' quality of life (QoL). The authors wanted to evaluate change in pain and QoL among rural patients after endovenous laser ablation (EVLA) treatment in a pilot study.

Methods Twenty patients having CVI who opted for 1,470-nm EVLA treatment were enrolled at the Interventional Radiology department between July 2018 and September 2018. The authors evaluated pain using the visual analog scale (VAS) before and after EVLA procedure (standard protocol) of the affected vein. They also assessed QoL using the Aberdeen Varicose Vein Questionnaire before and 6 weeks after EVLA.

Results The authors observed significant reduction in pain postprocedure versus preprocedure. Majority of the patients had improvement in itching and stasis dermatitis after the procedure. Rash and skin ulcers remained uncommon before and after EVLA. Also, after EVLA, fewer patients than before reported that the appearance of their diseased veins caused them concern (35 vs. 65% before EVLA), influenced their choice of clothing (45 vs. 80%), interfered with their work (40 vs. 90%), and interfered with their leisure activities (30 vs. 80%).

Conclusion EVLA 1470nm procedure may help patients with CVI attain improved QoL and significant pain reduction.

Keywords
- chronic venous insufficiency
- endovenous laser ablation
- varicose

Introduction

Chronic venous insufficiency (CVI), affecting approximately 15 to 20% of population,[1] is known to be an important cause of morbidity in the young and results in loss of wages for those affected.[2] There are significant affected numbers seen in the rural population of India. In one study from central India, 84% patients seen in the outpatient department (OPD) over a year were rural, whereas 15% were urban; the average monthly OPD attendance in the center was 23, out of which 20 belonged to rural areas and only 3 to urban areas.[3] Additionally, only a minority of patients with a long-term indication for the treatment of CVI or related conditions receive the needed therapy.[4]

In India, CVI has been identified as a common surgical problem in low socioeconomic groups.[5] Occupations involving prolonged standing and vigorous physical muscular activity lead to a high risk of developing CVI.[6] Increased venous pressure due to dysfunction or incompetence of venous valves results in superficial veins at multiple levels,

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received
February 25, 2019
accepted after revision
May 15, 2019
published online
July 18, 2019

DOI https://doi.org/10.1055/s-0039-1693631
ISSN 2457-0214.

leading to CVI. CVI is categorized as primary or secondary CVI. Primary CVI includes reflux at the saphenofemoral and saphenofemoral popliteal junctions, and segmental intrinsic reflux in the great saphenous vein (GSV) and small saphenous vein (SSV), whereas secondary CVI involves varicosities in patients with a previous history of deep vein thrombosis. Primary CVI is more common than secondary CVI, with the latter affecting approximately 18 to 28% of limbs.[7,8] Patients usually complain of pain and heaviness in calf precipitated after prolonged standing. Leg fatigue, itching, and the presence of varicosities in lower limbs eventually lead to leg ulceration known as classic venous ulcer.[9-11] Classic presentations of venous ulcers are along the medial aspect of the ankle, with the ulcer having a red base and an irregular shallow bed, and surrounding changes of stasis dermatitis. Unusually, these ulcers may be located along the posterior aspect of the ankle.

Both surgical and nonsurgical methods are used for treating CVI. Ablation therapy such as endovenous laser ablation (EVLA), radiofrequency ablation (RFA), and foam sclerotherapy are nonsurgical methods.[12] Surgical methods include ligation and stripping, subfascial endoscopic perforator surgery, and microphlebectomy.

To the best of our knowledge, while EVLA is being used regularly for the treatment of CVI, data on pain scores and quality of life (QoL) after EVLA in rural patients in Central India are scarce. We therefore wanted to evaluate change in pain and QoL among rural patients after EVLA treatment in a pilot study.

Methods

This study was designed as a prospective, observational pilot study for 2 months from July to September 2018. The study received approval from the institutional ethics committee. Twenty patients with symptomatic CVI in lower extremities presenting to the Interventional Radiology Department, Acharya Vinoba Bhave Rural Hospital, were selected through purposive sampling.

Patients meeting the following inclusion criteria were enrolled in the study: patients with valvular incompetence (i.e., reflux > 1 second) in superficial lower limb veins documented with color Doppler or Duplex ultrasound scanning and symptomatic patients with clinical–etiological–anatomical–pathophysiological (CEAP) C3 class or higher venous disease.[13] Patients with the following characteristics were excluded: active deep venous thrombosis, deep venous valve insufficiency, superficial venous thrombophlebitis at the time of procedure, patient currently pregnant or breast-feeding a child, severe coagulopathy that is resistant to correction, inability to coagulate, a history of reaction to contrast medium, or prior surgeries for varicose veins.

For ultrasound, a color duplex ultrasound scanner, Aloka Prosound Alpha-7 (Aloka Co. Ltd.), with a linear array transducer of high frequency was used. For EVLA, a Biolitec diode laser of 15 W and a wavelength of 1,470 nm along with radial fiber 5F vascular sheath and Terumo 0.035-inch hydrophilic guidewire were used. The EVLA procedure took place in the Interventional Radiology Cath Laboratory. For perforator and tortuous GSV/SSV, bare fiber was used, whereas, for straight/nontortuous veins, radial fiber was used.

Upon enrollment, patients were classified according to the CEAP classification. EVLA procedure was performed under local anesthesia using all aseptic precautions. Percutaneous access was established for the GSV and SSV. Then anesthesia was given along GSV using a mixture of 20 mL of 2% lignocaine diluted with 500 mL of normal saline with the help of 23G hypodermic needle. This was followed by laser ablation of the affected vein with standard protocol.[14]

Pain assessment using the visual analog scale (VAS) was performed before and after the laser ablation procedure.[15] VAS score was evaluated and compared across time intervals (pre- vs. postprocedure). In addition to evaluation using VAS, patients answered the Aberdeen Varicose Vein Questionnaire (AVVQ) before and 6 weeks after the EVLA procedure (►**Table 1**).[16] We used AVVQ without manikin.[17]

After the procedure, patients received antibiotics and analgesics for 5 days along with compression stockings. Patients were reevaluated on days 3 to 5 postprocedure to rule out any postprocedural complications. At the sixth week, patients answered the AVVQ (for QoL index) again and were evaluated for the status of residual disease.

The primary objective of the study was assessing change in pain scores before versus after EVLA under local anesthesia using VAS. The secondary objective was to assess QoL improvement in patients who undergo EVLA.

Continuous data were expressed as means ± standard deviation (SD) or as median and range, whereas questionnaire responses were quantified in percentages. Demographic and clinical measures were compared using paired Student's *t*-test for parametric variables and Wilcoxon's signed rank Test for nonparametric variables. SPSS version 22.0 (IBM Corp.) and Graph Pad Prism v6.0 (GraphPad Software) were used for analysis. A *p*-value of 0.05 was considered as the threshold of significance for null hypothesis significance testing.

Results

The average age of the patients was 42.7 years. The average age was 44.16 years in males (12 patients) and 40.5 years in females (8 patients). The male:female sex ratio was 1.5:1.

Preprocedure Evaluation

The preprocedural mean pain on VAS was 5.80 ± 1.64, with a standard error mean of 0.36.

►**Table 2** shows the distribution of responses to the AVVQ before EVLA procedure (►**Table 2**). Of the 20 patients with symptomatic CVI in lower extremities, the majority (11 patients) had right leg involvement, 7 patients had left leg involvement, and 2 patients had bilateral involvement (►**Table 2**).

Prior to EVLA procedure, patient's QoL in our cohort was affected by CVI as follows: in the last 2 weeks before the procedure, 16 (80%) patients had pain since 10 days or more, whereas 12 (60%) patients had taken analgesics for more than 10 days. A similar number of cases reported ankle swelling for more than 10 days as well as wearing

Table 1 Key to options in the AVVQ

Sr. no.	Question	Option 1	Option 2	Option 3	Option 4
1	Leg involved	Right Leg	Left Leg	Both Legs	–
2	In the last 2 wk for how many days did your veins cause you pain or ache?	None at all	Between 1 and 5 d	Between 6 and 10 d	> 10 d
3	During the last 2 wk, on how many days did you take pain killing tablets for your varicose vein?	None at all	Between 1 and 5 d	Between 6 and 10 d	> 10 d
4	In the last 2 wk, how much ankle swelling have you had?	None at all	Between 1 and 5 d	Between 6 and 10 d	> 10 d
5	In the last 2 wk, have you worn support stockings or tights?	No	Yes, those I bought myself without prescription	Yes, those were prescribed by my doctor and I wear them occasionally	Yes, those were prescribed by my doctor and I wear them every day
6	In the past 2 wk, have you had any itching in association with your varicose vein?	No	Yes, above the knee only	Yes, below the knee only	Yes, above and below the knee
7	Do you have stasis dermatitis caused by tiny blood vessels in the skin in association with the varicose vein?	Yes	No	–	–
8	Do you have rash or eczema in the area of your ankle?	Yes	No	–	–
9	Do you have a skin ulcer associated with your varicose vein?	Yes	No	–	–
10	Does the appearance of your varicose veins cause you concern?	No	Yes, their appearance causes me slight concern	Yes, their appearance causes me moderate concern	Yes, their appearance causes me a great deal of concern
11	Does the appearance of your varicose veins influence your choice of clothing including tights?	No	Occasionally	Often	Always
12	During the last 2 wk, have your varicose veins interfered with your work, housework, or other activities?	No	I have been able to work, but my work has suffered to a slight extent	I have been able to work, but my work has suffered to a moderate extent	My veins have prevented me from working 1 d or more
13	During the last 2 wk, have your varicose veins interfered with your leisure activities?	No	Yes, my enjoyment has suffered to a slight extent	Yes, my enjoyment has suffered to a moderate extent	Yes, my veins have prevented me from taking part in any leisure activities

Abbreviation: AVVQ, Aberdeen Varicose Vein Questionnaire.

prescribed support stockings or tights daily. Itching and stasis dermatitis were common complaints (14 and 17 patients, respectively). Rash and skin ulcers were uncommon occurrences.Patients also consistently reported that the appearance of varicose veins caused them concern (65% patients), influenced their choice of clothing (80% patients), interfered with their work (90%), and interfered with their leisure activities (80%).

Intraprocedure Evaluation

The mean pain on VAS was reduced to 4.00 ± 1.29, with a standard error mean of 0.29 during EVLA procedure. Six patients experienced moderate needle prick pain, whereas 12 patients experienced heat and pain during ablation of the vein.

Postprocedural Evaluation

The mean pain on VAS was further reduced to 2.55± 1.19, with a standard error mean of 0.26.

►**Table 3** shows the postprocedural (6 weeks after EVLA) distribution of responses to AVVQ. Compared with the preprocedural evaluation, we found dramatic increase in the numbers of patients reporting improved QoL. In the last 2 weeks of the follow-up, 15 (75%) patients had no pain associated with the varicose veins compared with just 1 patient before EVLA. Similarly, the numbers of those taking analgesics for > 10 days (two patients), those having ankle swelling for > 10 days (two patients), and those who wore prescribed stockings every day (four patients) were reduced compared with preprocedure when the majority had these issues.

Table 2 Distribution of responses to AVVQ (preprocedure)

Sr. no.	Question	Option 1	Option 2	Option 3	Option 4	Total
1	Leg involved	11 (55%)	7 (35%)	2 (10%)	–	20 (100%)
2	In the last 2 wk, for how many days did your veins cause you pain or ache?	1 (5%)	1 (5%)	2 (10%)	16 (80%)	20 (100%)
3	During the last 2 wk, on how many days did you take pain killing tablets for your varicose vein?	6 (30%)	1 (5%)	1 (5%)	12 (60%)	20 (100%)
4	In the last 2 wk, how much ankle swelling have you had?	5 (25%)	1 (5%)	2 (10%)	12 (60%)	20 (100%)
5	In the last 2 wk, have you worn support stockings or tights?	2 (10%)	4 (20%)	2 (10%)	12 (60%)	20 (100%)
6	In the past 2 wk, have you had any itching in association with your varicose vein?	6 (30%)	2 (10%)	9 (45%)	3 (15%)	20 (100%)
7	Do you have stasis dermatitis caused by tiny blood vessels in the skin in association with the varicose vein?	17 (85%)	3 (15%)	–	–	20 (100%)
8	Do you have rash or eczema in the area of your ankle?	7 (35%)	13 (65%)	–	–	20 (100%)
9	Do you have a skin ulcer associated with your varicose vein?	5 (25%)	15 (75%)	–	–	20 (100%)
10	Does the appearance of your varicose veins cause you concern?	7 (35%)	7 (35%)	4 (20%)	2 (10%)	20 (100%)
11	Does the appearance of your varicose veins influence your choice of clothing including tights?	4 (20%)	10 (50%)	2 (10%)	4 (20%)	20 (100%)
12	During the last 2 wk, have your varicose veins interfered with your work, housework, or other activities?	2 (10%)	8 (40%)	6 (30%)	4 (20%)	20 (100%)
13	During the last 2 wk, have your varicose veins interfered with your leisure activities?	4 (20%)	10 (50%)	2 (10%)	4 (20%)	20 (100%)

Abbreviation: AVVQ, Aberdeen Varicose Vein Questionnaire.

Note: Refer to ►**Table 1** to see options for each question in the questionnaire.

After EVLA, the numbers of those who no longer suffered from itching doubled, whereas those who no longer had stasis dermatitis more than quadrupled (from just 3 patients earlier to 14 after EVLA). Rash and skin ulcers became even more uncommon (80–90% patients reported that they did not have these issues).

After EVLA, fewer patients reported that the appearance of their diseased veins caused them concern (35% patients, down from 65%), that it influenced their choice of clothing (45% patients, down from 80%), that it interfered with their work (40% patients, down from 90%), and also interfered with their leisure activities (30%, down from 80%).

Statistically significant difference was observed between pre- and postprocedural mean scores in every question of AVVQ ($p < 0.05$) except for (related to rash/eczema) and (related to skin ulcers) (using Wilcoxon's signed rank test)[18] (►**Table 4**).

Visual analog scale score was measured pre-, intra-, and postprocedure; the observations are provided in ►**Table 5** and the statistical comparison is provided in ►**Table 6** and ►**Fig. 1**.

The disease progression was decreased in 14 patients, constant in 4 patients, and increased in 2 patients.

Discussion

A pilot study of 20 rural patients with symptomatic CVI in lower extremities presenting to the Interventional Radiology department over 2 months showed that pain scores reduced from pre- to post-EVLA procedure and QoL improved significantly in several aspects.

Advanced treatment for CVI includes EVLA and RFA. The first application of thermal endovenous ablation using 810-nm diode laser was published by Navarro et al[19] in 2001. Since then, numerous studies using different wavelengths and types of lasers have demonstrated effectiveness.[20] In parallel to advances in laser technology, studies were performed concerning thermal ablation and saphenous vein using radiofrequency energy, and in 2002, Weiss and Weiss reported the first patient receiving thermal ablation using radiofrequency energy.[21] Doganci and Demirkilic reported fewer side effects and better patient satisfaction in high wavelength laser energy and radial fiber treatment compared with low wavelength laser energy and bare fiber.[22] Glue injections in GSV/SSV are recent advances for the ablation of veins.[23]

EVLA acts through occlusion and fibrosis of vessel lumen by applying thermal energy on the vessel wall of affected veins.

Table 3 Distribution of responses to AVVQ (postprocedure)

Sr. no.	Question	Option 1	Option 2	Option 3	Option 4	Total
1	Leg involved	11 (55%)	7 (35%)	2 (10%)	–	20 (100%)
2	In the last 2 wk, for how many days did your veins cause you pain or ache?	15 (75%)	2 (10%)	2 (10%)	1 (5%)	20 (100%)
3	During the last 2 wk, on how many days did you take pain killing tablets for your varicose vein?	14 (70%)	1 (5%)	3 (15%)	2 (10%)	20 (100%)
4	In the last 2 wk, how much ankle swelling have you had?	12 (60%)	2 (10%)	4 (20%)	2 (10%)	20 (100%)
5	In the last 2 wk, have you worn support stockings or tights?	10 (50%)	4 (20%)	2 (10%)	4 (20%)	20 (100%)
6	In the past 2 wk, have you had any itching in association with your varicose vein?	12 (60%)	2 (10%)	4 (20%)	2 (10%)	20 (100%)
7	Do you have stasis dermatitis caused by tiny blood vessels in the skin in association with the varicose vein?	6 (30%)	14 (70%)	–	–	20 (100%)
8	Do you have rash or eczema in the area of your ankle?	4 (20%)	16 (80%)	–	–	20 (100%)
9	Do you have a skin ulcer associated with your varicose vein?	2 (10%)	18 (90%)	–	–	20 (100%)
10	Does the appearance of your varicose veins cause you concern?	13 (65%)	1 (5%)	5 (25%)	1 (5%)	20 (100%)
11	Does the appearance of your varicose veins influence your choice of clothing including tights?	11 (55%)	3 (15%)	4 (20%)	2 (10%)	20 (100%)
12	During the last 2 wk, have your varicose veins interfered with your work, housework, or other activities?	12 (60%)	2 (10%)	4 (20%)	2 (10%)	20 (100%)
13	During the last 2 wk, have your varicose veins interfered with your leisure activities?	14 (70%)	2 (10%)	2 (10%)	2 (10%)	20 (100%)

Abbreviation: AVVQ, Aberdeen Varicose Vein Questionnaire.

Note: refer to ►**Table 1** to see options for each question in the questionnaire.

Table 4 Comparison of quality-of-life improvement score in patients with chronic venous insufficiency by AVVQ using Wilcoxon's signed rank test

Question no.	Preprocedure		Postprocedure		*z*-Value	*p*-Value
	Mean	SD	Mean	SD		
1	1.55	0.68	1.55	0.68	–	–
2	3.65	0.81	1.45	0.88	9.314	0.0001, S
3	2.95	1.39	1.65	1.08	4.466	0.0001, S
4	3.05	1.31	1.80	1.10	4.802	0.0001, S
5	3.20	1.10	2.00	1.21	5.080	0.0001, S
6	2.45	1.09	1.80	1.10	3.115	0.006, S
7	1.15	0.36	1.70	0.47	4.819	0.0001, S
8	1.65	0.48	1.80	0.41	1.831	0.083, NS
9	1.75	0.44	1.90	0.30	1.831	0.083, NS
10	2.05	0.99	1.70	1.03	3.199	0.005, S
11	2.30	1.03	1.85	1.08	3.943	0.001, S
12	2.60	0.94	1.80	1.10	5.812	0.0001, S
13	2.30	1.03	1.60	1.04	6.658	0.0001, S

Abbreviations: AVVQ, Aberdeen Varicose Vein Questionnaire; NS, nonsignificant; S, significant; SD, standard deviation.

Table 5 Comparison of pain on VAS in different time intervals: descriptive statistics

	Mean	*N*	Standard deviation	Standard error mean
Preprocedure	5.80	20	1.64	0.36
Intraprocedure	4.00	20	1.29	0.29
Postprocedure	2.55	20	1.19	0.26

Abbreviation: VAS, visual analog scale.

t-test was statistically significant, as seen in ►**Table 6** and ►**Fig. 1**. Our findings are similar to those in the study by Houtermans-Auckel et al.[25]

The AVVQ comprising 13 questions is used for measuring QoL in patients with varicose veins of the leg.[16] There are questions relating to the amount of pain experienced, ankle swelling, interference with social and domestic activities, and cosmetic aspects of varicose veins. In our cohort, we found statistically significant improvement in mean AVVQ scores after treatment. AVVQ scores improved at 6 weeks

Table 6 Student's paired t-test

	Paired differences					*t*	df	*p*-Value
	Mean	Standard deviation	Standard error mean	95% confidence interval of the difference				
				Lower	Upper			
Pre- and intraprocedure	1.80	0.89	0.20	1.38	2.21	9.000	19	0.0001, S
Pre- and postprocedure	3.25	1.20	0.27	2.68	3.81	12.027	19	0.0001, S
Intra- and postprocedure	1.45	0.68	0.15	1.12	1.77	9.448	19	0.0001, S

Abbreviation: df, degree of freedom.

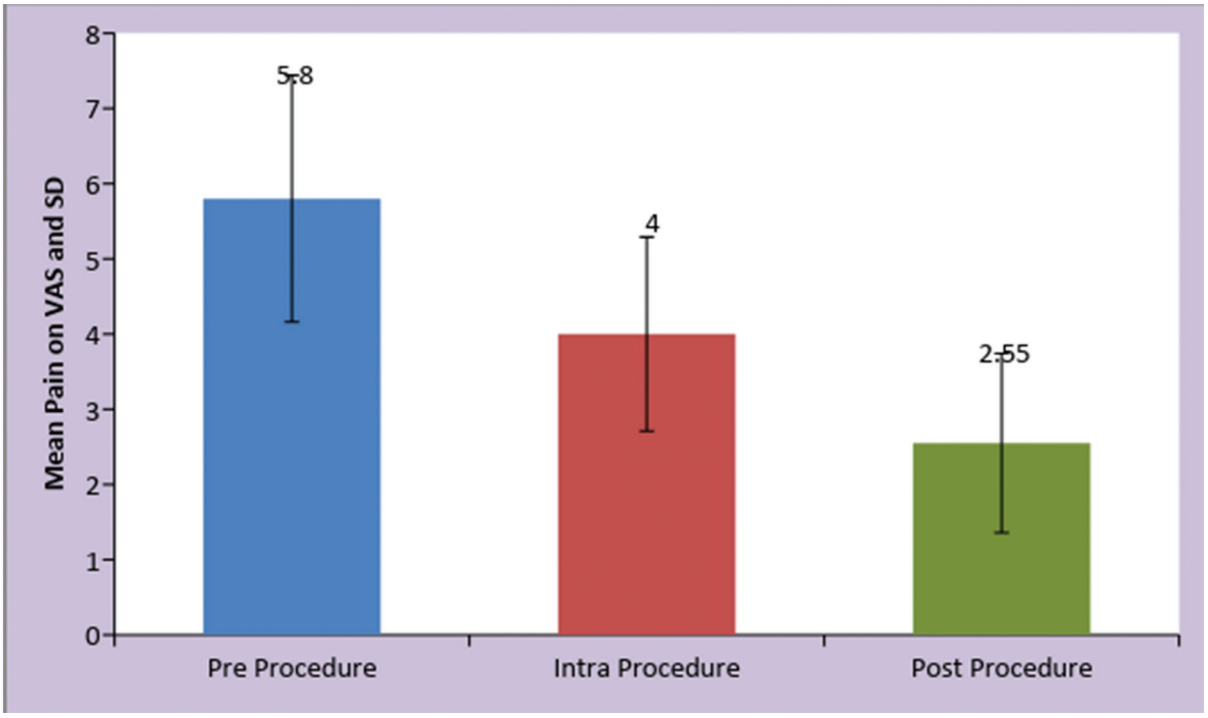

Fig. 1 Comparison of pain on visual analog scale in different time intervals.

Compared with surgical management of CVI incorporating surgical ligation, EVLA has more promising long-term follow-up.[24] Diagnosis and management of CVI in the rural population of India is necessary, particularly since patients from this demographic tend to have long-standing disease with late presentation. In contrast, patients from urban areas tend to present earlier and are more concerned with early skin changes.[3]

Mean pain on VAS reduced from 5.80 ± 1.64 before EVLA to 2.55 ± 1.19 six weeks after the procedure. The pre-to postprocedure comparisons using Student's paired

for all questions except for and (p = 0.083) related to skin rash/eczema and skin ulcers, respectively (►**Table 4**) and (►**Fig. 2**). We hypothesize that with longer follow-up, we might find significant reduction in these two aspects as well. Our study is congruent with studies such as the one by Lattimer et al,[26] in which the majority responded to change and had improved AVVQ scores after procedure.[27-29]

During the sixth week of follow-up, disease progression was decreased in 14 patients. It was found out to be constant in four patients due to severity of the disease and

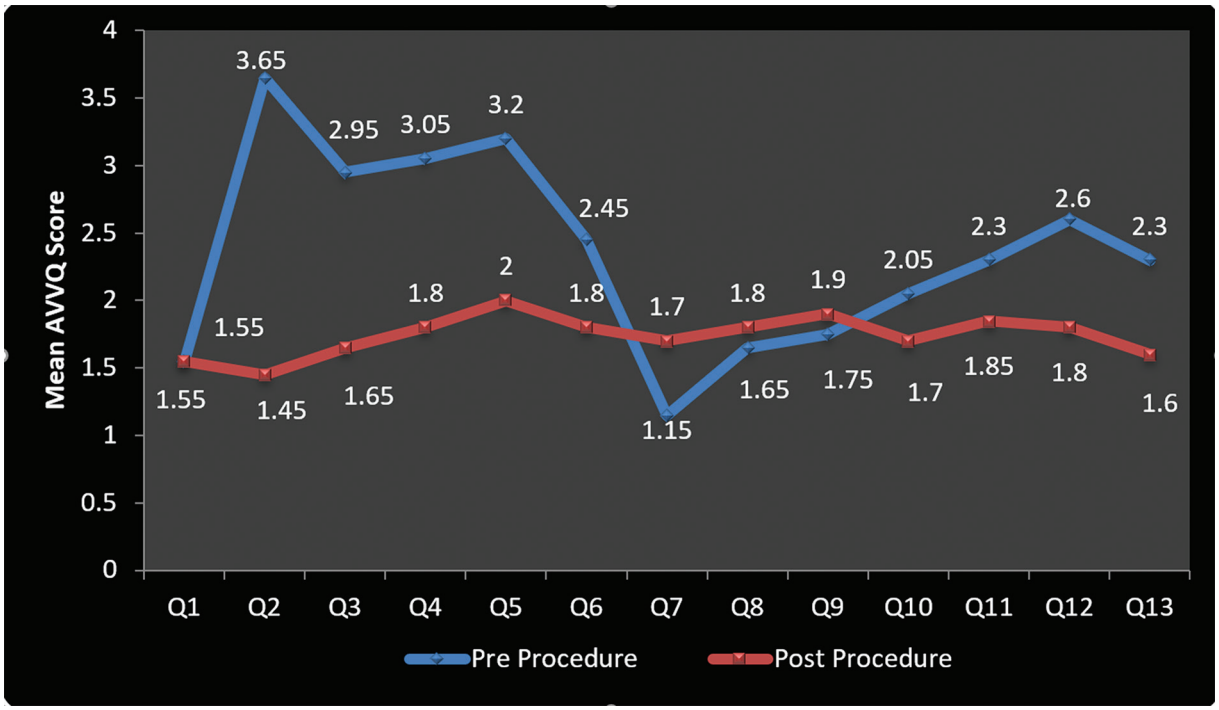

Fig. 2 Comparison of mean Aberdeen Varicose Vein Questionnaire (AVVQ) score pre- and postprocedure.

chronicity, with multiple underlying perforator and superficial varicosities postablation. The patients with the disease remaining constant were advised subsequent treatment measures such as extended use of stockings, calf-pumping exercises, percutaneous sclerotherapy, microphlebectomy and wound management using platelet-rich plasma injection,[30] and platelet-rich fibrin for wound healing as per suitability of the case. Two cases had progression of disease. These were further evaluated for the etiopathogenesis of progression and the evaluation of developing complications. One patient had developed a minor complication of superficial thrombophlebitis postprocedure and was prescribed management with antibiotics and local magnesium sulfate dressing.[31]

Ours was a pilot study, which by definition has a small sample size designed to be executed within our existing resources. Additionally, the follow-up period was short. We acknowledge these limitations. A larger sample size is likely to help improve the quality of evidence demonstrated by our study. We hope that the evidence presented through this study justifies acquiring the necessary resources and time for a larger and longer study that produces more robust evidence.

In conclusion, VAS comparison shows better pain scores postprocedure than preprocedure, suggestive of improvement in pain associated with CVI. Post-EVLA, significant improvement is reported by patients in AVVQ, suggesting improvement in QoL. Thus, 1470-nm EVLA using in rural patients with CVI may have a significant effect on QoL and pain.

Institutional Review Board Statement

This study was reviewed and approved by the ethics committee of Jawaharlal Nehru Medical College on March 28, 2018.

Biostatistics Statement

The statistical methods and results were reviewed and verified by a member of the medical statistics of Jawaharlal Nehru Medical College.

Conflicts of Interests

None.

Acknowledgments

None.

References

1 Ravikumar BL, Satish Kumar R, Francisco Menezes JV, Jain A. Our experience in the management of varicose veins of the lower limb. J Evol Med Dent Sci 2014;3(16):4137–4144
2 Adhikari A, Criqui MH, Wooll V, et al. The epidemiology of chronic venous diseases. Phlebology 2000;15(1):2–18
3 Mohan A, Banode P, Sharma G. Chronic venous insufficiency: a study of clinical presentation at a rural hospital and its management in Interventional Radiology clinic. Int J Sci Res (Ahmedabad) 2018;7(6):3–6
4 Rabe E, Hertel S, Bock E, Hoffmann B, Jöckel K-H, Pannier F. Therapy with compression stockings in Germany - results from the Bonn Vein Studies. J Dtsch Dermatol Ges 2013;11(3):257–261
5 Callam MJ. Epidemiology of varicose veins. Br J Surg 1994;81(2):167–173
6 Mirji P, Emmi S, Joshi C. Study of clinical features and management of varicose veins of lower limb. J Clin Diagn Res 2011;5(7):1416–1420
7 Kistner RL, Eklof B, Masuda EM. Diagnosis of chronic venous disease of the lower extremities: the "CEAP" classification. Mayo Clin Proc1996;71(4)338–345
8 Labropoulos N. CEAP in clinical practice. Vasc Surg 1997;31(3):224–225
9 Bradbury A, Evans C, Allan P, Lee A, Ruckley CV, Fowkes FG. What are the symptoms of varicose veins? Edinburgh vein study cross sectional population survey. BMJ 1999;318(7180):353–356

10 Vasudevan B. Venous leg ulcers: pathophysiology and classification. Indian Dermatol Online J 2014;5(3):366–370
11 Golledge J, Quigley FG. Pathogenesis of varicose veins. Eur J Vasc Endovasc Surg 2003;25(4):319–324
12 Carroll C, Hummel S, Leaviss J, et al. Clinical effectiveness and cost-effectiveness of minimally invasive techniques to manage varicose veins: a systematic review and economic evaluation. Health Technol Assess 2013;17(48):i–xvi,1–141
13 Eklöf B, Rutherford RB, Bergan JJ, et al; American Venous Forum International Ad Hoc Committee for Revision of the CEAP Classification. Revision of the CEAP classification for chronic venous disorders: consensus statement. J Vasc Surg 2004;40(6):1248–1252
14 Min RJ, Khilnani N, Zimmet SE. Endovenous laser treatment of saphenous vein reflux: long-term results. J Vasc Interv Radiol 2003;14(8):991–996
15 Torrance GW, Feeny D, Furlong W. Visual analog scales: do they have a role in the measurement of preferences for health states? Med Decis Making 2001;21(4):329–334
16 Garratt AM, Macdonald LM, Ruta DA, Russell IT, Buckingham JK, Krukowski ZH. Towards measurement of outcome for patients with varicose veins. Qual Health Care 1993;2(1):5–10
17 Staniszewska A, Cotton S, MacLennan G, Brittenden J. Modifying a validated instrument: the Aberdeen varicose vein questionnaire. Trials 2015;16(2):56
18 Rosner B, Glynn RJ, Lee M-LT. The Wilcoxon signed rank test for paired comparisons of clustered data. Biometrics 2006;62(1):185–192
19 Navarro L, Min RJ, Boné C. Endovenous laser: a new minimally invasive method of treatment for varicose veins—preliminary observations using an 810 nm diode laser. Dermatol Surg 2001;27(2):117–122
20 Galanopoulos G, Lambidis C. Minimally invasive treatment of varicose veins: Endovenous laser ablation (EVLA). Int J Surg 2012;10(3):134–139
21 Weiss RA, Weiss MA. Controlled radiofrequency endovenous occlusion using a unique radiofrequency catheter under duplex guidance to eliminate saphenous varicose vein reflux: a 2-year follow-up. Dermatol Surg 2002;28(1):38–42
22 Doganci S, Demirkilic U. Comparison of 980 nm laser and bare-tip fibre with 1470 nm laser and radial fibre in the treatment of great saphenous vein varicosities: a prospective randomised clinical trial. Eur J Vasc Endovasc Surg 2010;40(2):254–259
23 Coupland A, Stansby G. Glue for superficial venous ablation. Rev Vac Med 2014;2(3):98–102
24 Disselhoff BC, der Kinderen DJ, Kelder JC, Moll FL. Five-year results of a randomised clinical trial of endovenous laser ablation of the great saphenous vein with and without ligation of the saphenofemoral junction. Eur J Vasc Endovasc Surg 2011;41(5):685–690
25 Houtermans-Auckel JP, van Rossum E, Teijink JA, et al. To wear or not to wear compression stockings after varicose vein stripping: a randomised controlled trial. Eur J Vasc Endovasc Surg 2009;38(3):387–391
26 Lattimer CR, Kalodiki E, Azzam M, Geroulakos G. Responsiveness of individual questions from the venous clinical severity score and the Aberdeen varicose vein questionnaire. Phlebology 2014;29(1):43–51
27 Klem TM, Sybrandy JE, Wittens CH. Measurement of health-related quality of life with the Dutch translated Aberdeen Varicose Vein Questionnaire before and after treatment. Eur J Vasc Endovasc Surg 2009;37(4):470–476
28 Kuet M-L, Lane TR, Anwar MA, Davies AH. Comparison of disease-specific quality of life tools in patients with chronic venous disease. Phlebology 2014;29(10):648–653
29 Mariani F. Lower-limb venous symptoms and assessment of quality of life: existing tools. Medicographia [Internet]. Available at: https://www.medicographia.com/2015/06/lower-limb-venous-symptoms-and-assessment-of-quality-of-life-existing-tools/. Accessed April 20, 2019
30 Lacci KM, Dardik A. Platelet-rich plasma: support for its use in wound healing. Yale J Biol Med 2010;83(1):1–9
31 Dunst KM, Huemer GM, Wayand W, Shamiyeh A. Diffuse phlegmonous phlebitis after endovenous laser treatment of the greater saphenous vein. J Vasc Surg 2006;43(5):1056–1058